

## 3.5 Geology, Soils, and Seismicity

### Environmental Setting

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This section describes geology, soils, and seismicity in the city of Carlsbad. The information contained in this section is based on the review of relevant information from the California Department of Conservation, California Geological Survey, and a Geotechnical Reconnaissance Survey for the Plaza Camino Real Shopping Center Project prepared by Geocon Inc. in 2010.<sup>1</sup>

#### PHYSICAL SETTING

##### Regional Geology

San Diego County is divided into three distinct geologic areas: the Coastal Plain region, Peninsular Ranges region, and Salton Trough region.

The Coastal Plain region includes most of western San Diego County and consists primarily of Mesozoic crystalline rocks underlain by marine and non-marine sedimentary rocks. In this region, drastic land and sea fluctuations have preserved ancient marine rocks up to elevations around 900 feet and ancient river deposits up to 1,200 feet. The Peninsular Ranges region includes much of eastern San Diego County and consists primarily of plutonic rocks that formed from the cooling of molten magmas deep within the Earth's crust between 140 and 90 million years ago. Other sediments are now preserved in this region as marbles, slates, schist, quartzites, and gneiss deposits. The Salton Trough or Colorado Desert region includes the eastern third of San Diego County and is characterized by late Miocene-aged marine sedimentary rocks and Pleistocene-aged stream and playa lake deposits (Deméré n.d.).

##### Local Geology and Soils

Carlsbad is within the coastal portion of the Peninsular Ranges Geomorphic Province, a region characterized by northwest-trending structural blocks and intervening fault zones. Typical lithologies in the Peninsular Ranges include a variety of igneous, intrusive rocks associated with the Cretaceous-age (between approximately 65 and 135 million years old) Southern California Batholith (a large igneous intrusive body). In western San Diego County, batholithic rocks are

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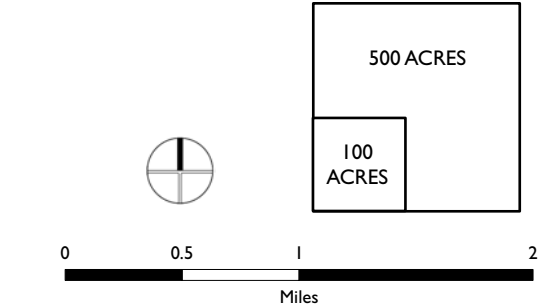
<sup>1</sup> Geocon Inc. 2010. *Geotechnical Reconnaissance Report for the Plaza Camino Real Shopping Center Revitalization Project*. Prepared by Geocon Inc. for Helix Environmental Planning, Inc. January 28, 2010.

often intruded into Jurassic-age (between approximately 135 and 195 million years old) metavolcanic and/or metasedimentary units, with these basement rocks locally overlain by Tertiary-age (between approximately 2 and 65 million years old) marine and non-marine sedimentary strata. Tertiary rocks in the western portion of the county are associated primarily with a number of sea level advance and retreat cycles over approximately the last 55 million years, including sedimentary units in Carlsbad and vicinity as described below.

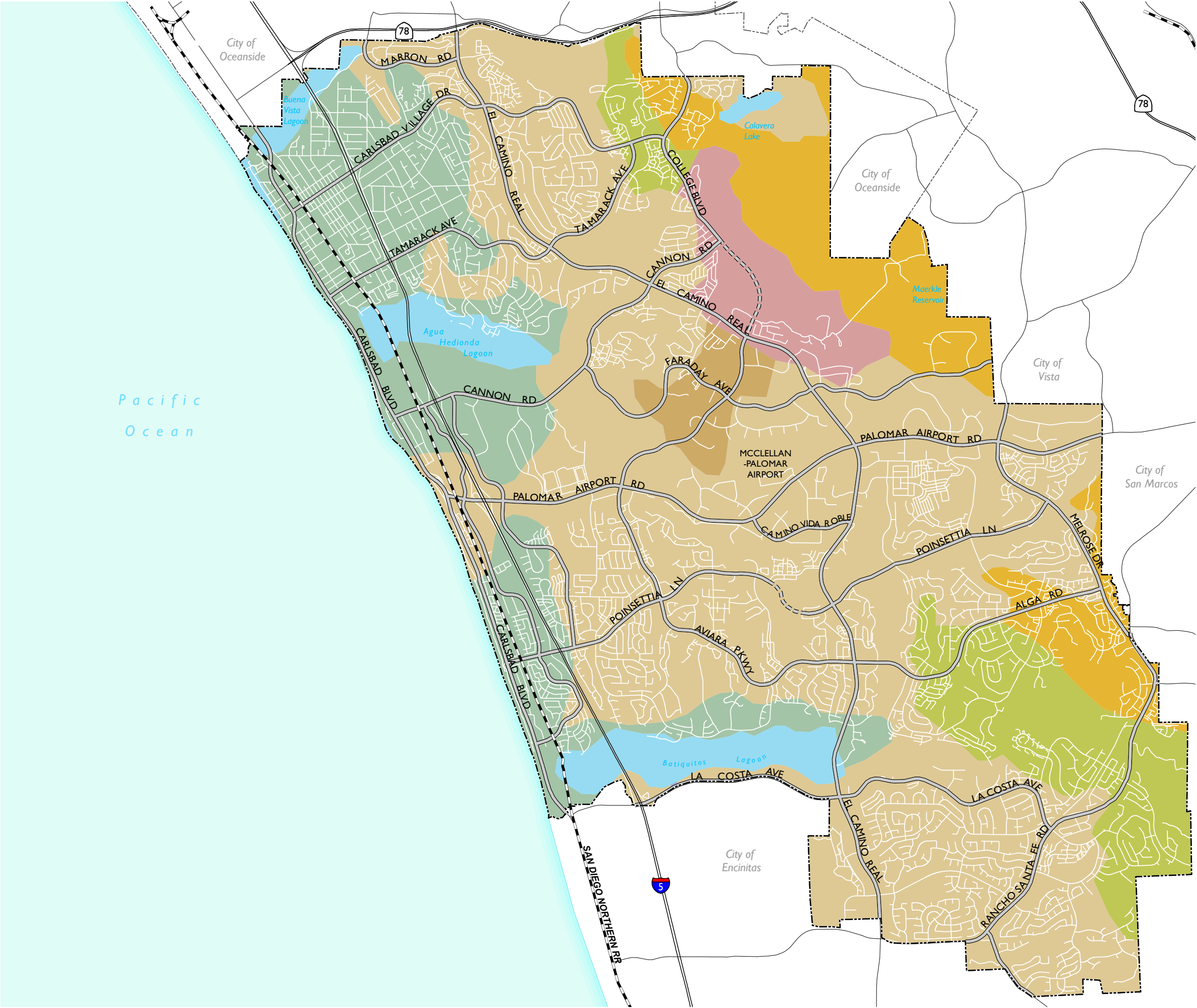
Topographically, the Peninsular Ranges Province is composed of generally parallel ranges of steep-sloping hills and mountains separated by alluvial valleys. More recent uplift and erosion has produced the characteristic canyon and mesa topography present today in western San Diego County, as well as the deposition of surficial materials including Quaternary-age (less than approximately two million years old) alluvium, colluvium and topsoil. The geology in the Oceanside Quadrangle, in which the city is located, is shown in Figure 3.5-1.

Figure 3.5-1  
PROPOSED  
GENERAL PLAN  
Geologic Map of the  
Oceanside Quadrangle

- Alluvium
- Cretaceous marine undivided
- Eocene marine
- Mesozoic granitic rocks
- Upper Cretaceous marine
- Mesozoic volcanic and metavolcanic
- Pliocene marine
- Water
- Highways
- Major Street
- Planned Street
- Railroad
- City Limits



Source: City of Carlsbad, 2013; DUDEK, 2013; SANDAG, 2013; Dyett & Bhatia, 2013.



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## **Geologic Hazards**

### **Earthquake Faults**

Figure 3.5-2 displays the location and extent of the profiled earthquake faults within San Diego County based on a United States Geological Survey (USGS) earthquake model that shows probabilistic peak ground acceleration. There are no active faults that run directly through Carlsbad. Additionally, the California Geological Survey does not include Carlsbad on its list of cities affected by Alquist–Priolo Earthquake Fault Zones. The nearest fault to the city is the Newport–Inglewood–Rose Canyon Fault, which runs offshore of the western edge of the city and is considered active.<sup>2</sup> Other faults in the region include the Coronado Bank, La Nacion, Elsinore, Agua Caliente, and San Jacinto.

Fault activity has the potential to result in ground shaking, which can be of varying intensity depending on the intensity of earthquake activity, proximity to that activity, and local soils and geology conditions. Carlsbad is located within a seismically active region, and earthquakes have the potential to cause ground shaking of significant magnitude. Although located near fault lines, Carlsbad lies within a medium-low probabilistic peak ground acceleration zone.

Historic documents record that an earthquake centered either on the Rose Canyon or Coronado Bank faults struck San Diego on May 27, 1862, damaging buildings in Old Town and causing ground rupture near the San Diego River mouth. This earthquake is believed to have had a magnitude of about 6.0 based on descriptions of the damage it caused. The strongest recorded earthquake in the San Diego area was a magnitude of 5.3 on the Richter scale that struck on July 13, 1986, on the Coronado Bank fault, 25 miles offshore of Solana Beach. There have been several moderate earthquakes recorded within the Rose Canyon Fault Zone as well. On June 17, 1985, three earthquakes hit San Diego measuring 3.9, 4.0, and 3.9, respectively, and on October 28, 1986, a stronger earthquake with a magnitude of 4.7 occurred.<sup>3</sup>

### **Landslides**

Some of the natural causes of landslides are earthquakes, streams, and heavy rainfall. In addition, certain human activities tend to make Earth materials less stable and increase the chance of ground failure. Activities contributing to instability include extensive irrigation, poor drainage or groundwater withdrawal, removal of stabilizing vegetation, and over-steepening of slopes by undercutting them or overloading them with artificial fill. These causes of ground failure, which normally produce landslides and differential settlement, are augmented during earthquakes by strong ground motion. Landslide risk is determined by steep slopes that have 25% or greater

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<sup>2</sup> Treiman, J.A., and M.M. Lundberg, compilers. 1999. "Fault number 127d, Newport-Inglewood-Rose Canyon fault zone, Oceanside section." Quaternary Fault and Fold Database of the United States. U.S. Geological Survey. Accessed September 24, 2012. <http://earthquakes.usgs.gov/regional/qfaults>.

<sup>3</sup> Deméré, T.A. n.d. "Geology of San Diego County." San Diego Natural History Museum. Accessed August 5, 2013. <http://www.sdnhm.org/archive/research/paleontology/sdgeol.html>.

incline, soil series data, and soil-slip susceptibility. Carlsbad does not include any areas identified as being susceptible to landslides and the overall risk of landslides is low.<sup>4</sup>

### **Liquefaction**

Liquefaction is a process in which uniform, clean, loose, fine sandy, and silty sediments below the water table temporarily lose strength during an earthquake and behave as a viscous liquid rather than a solid. Liquefaction is restricted to certain geologic and hydrologic environments, primarily recently deposited sand and silt in areas with high groundwater levels. Generally, the younger and looser the sediment, and the higher the water table, the more susceptible the soil is to liquefaction. Sediments most susceptible to liquefaction include Holocene (less than 10,000-year-old) delta, river channel, flood plain, aeolian deposits, and poorly compacted fills. Dense soils, including well-compacted fills, have low susceptibility to liquefaction.

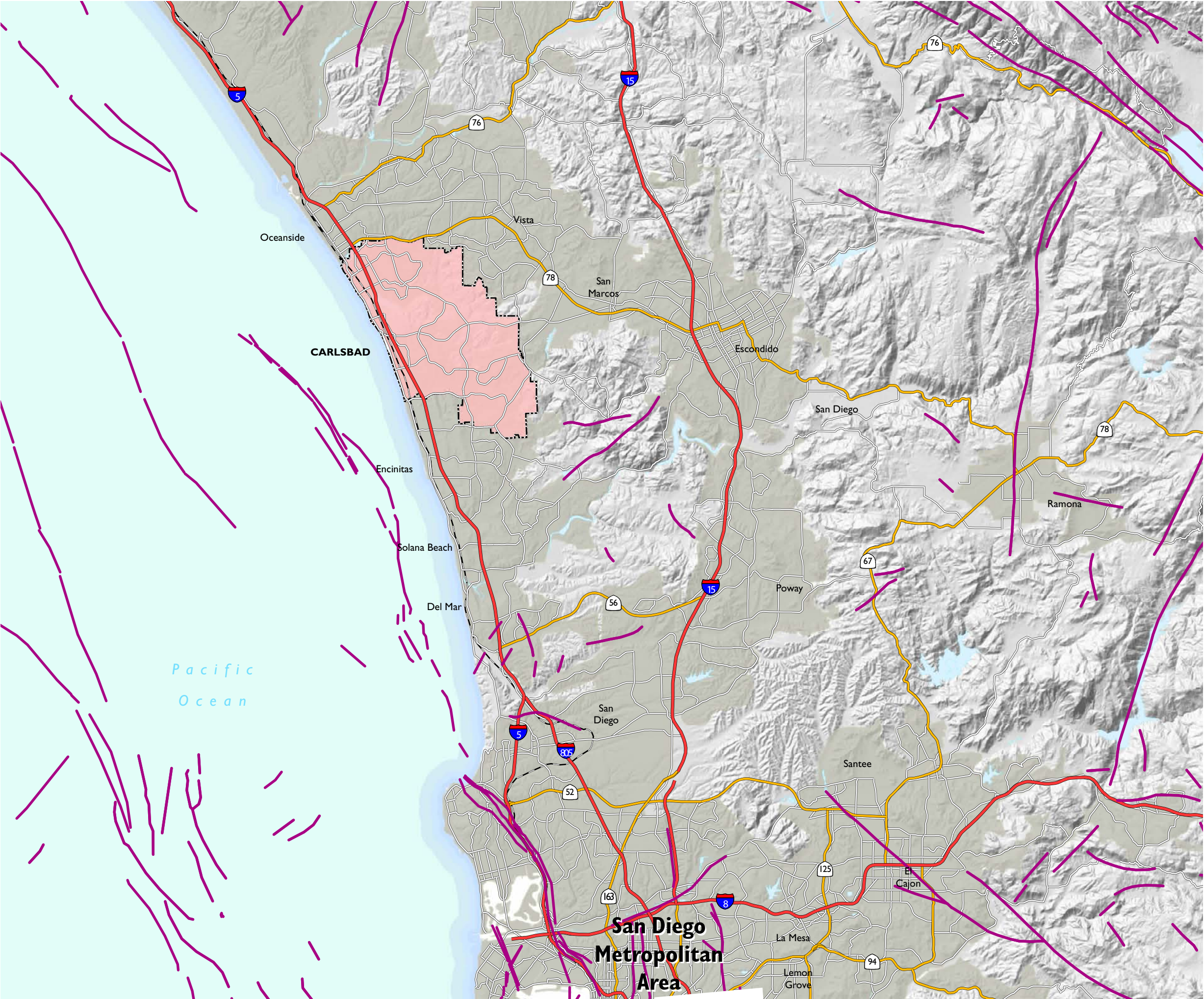
Liquefaction can cause the soil beneath a structure to lose strength, which may result in the loss of foundation-bearing capacity. This loss of strength commonly causes the structure to settle or tip. Loss of bearing strength can also cause light buildings with basements, buried tanks, and foundation piles to rise buoyantly through the liquefied soil. Historically, seismic shaking levels in the San Diego region, including Carlsbad, have not been sufficient enough to trigger liquefaction. The city has a low liquefaction risk; however, there are areas of the city that have a higher risk of liquefaction due to the presence of hydric soils or soils that are often saturated or characteristic of wetlands. These areas are limited to the immediate vicinity of the Buena Vista, Agua Hedionda, and Batiquitos lagoons, as shown in Figure 3.5-3.

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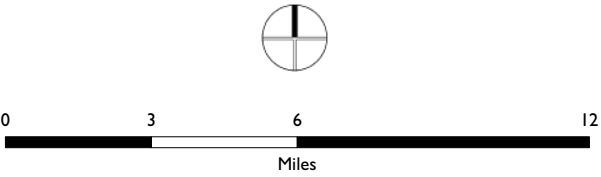
<sup>4</sup> County of San Diego. 2010. San Diego Multi-Jurisdictional Hazard Mitigation Plan. Available: [http://www.co.san-diego.ca.us/oes/emergency\\_management/oes\\_jl\\_mitplan.html](http://www.co.san-diego.ca.us/oes/emergency_management/oes_jl_mitplan.html). Accessed: March 10, 2014.



Figure 3.5-2  
PROPOSED GENERAL PLAN  
Earthquake Faults



- Earthquake Fault Lines
- Freeway
- Major Highway
- Minor Highway/Major Street
- Passenger Rail Lines
- County Lines
- City of Carlsbad
- Urban Areas



Source: ESRI, 2009; City of Carlsbad, 2013; DUDEK, 2013; USGS, 2002; Dyett & Bhatia, 2013.

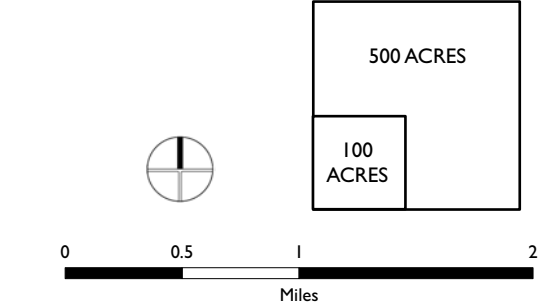
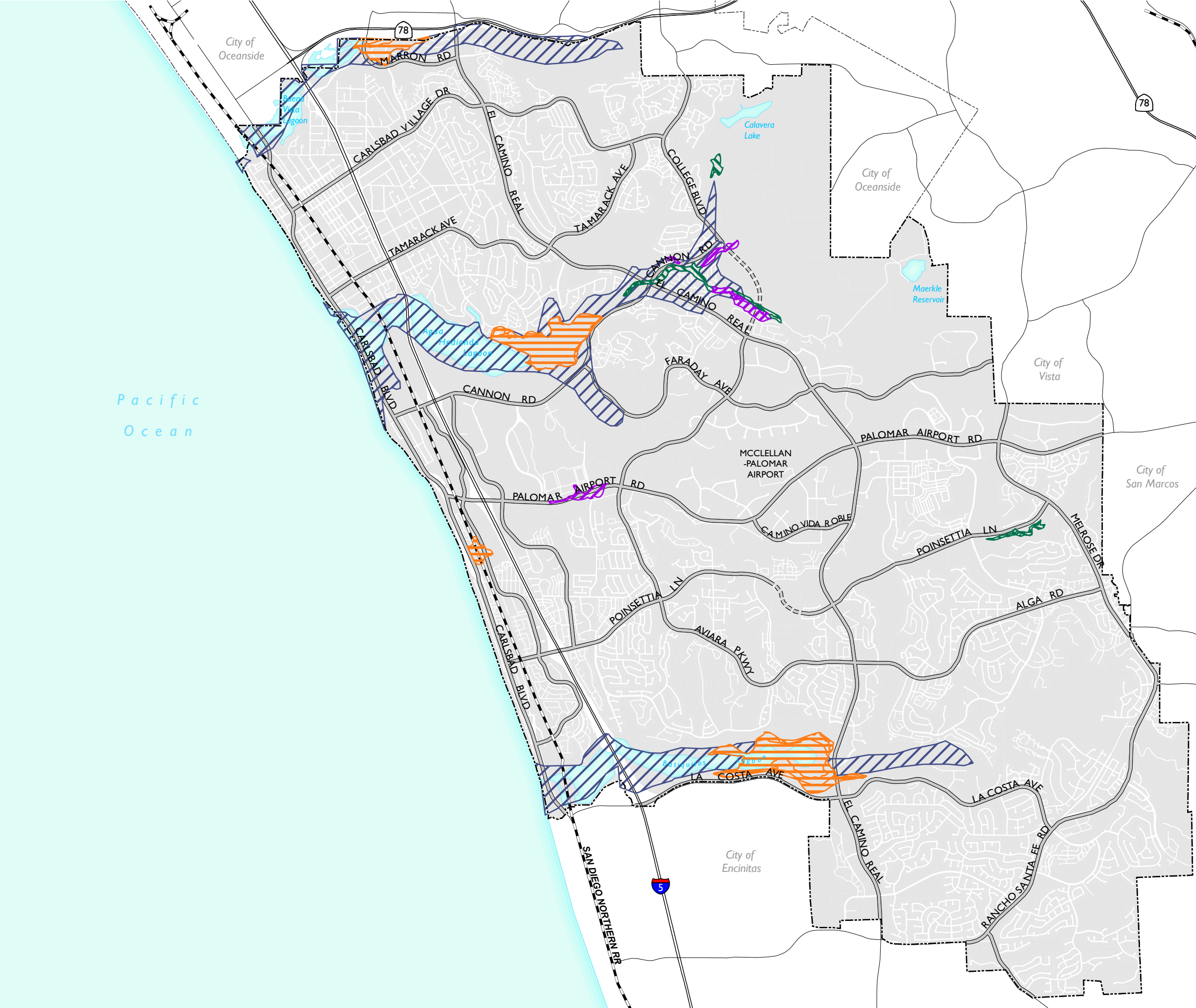


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Figure 3.5-3  
PROPOSED GENERAL PLAN  
Liquefaction Hazards

- Potential Liquefaction
- Riverwash
  - Tidal flats
  - Tujunga sand, 0 to 5 percent slopes
  - Other Hazard

- Highways
- Major Street
- Planned Street
- Railroad
- City Limits



Source: City of Carlsbad, 2013; DUDEK, 2013; SANDAG, 2013; Dyett & Bhatia, 2013.

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### **Soil Erosion**

Erosion occurs when materials on the Earth's surface are loosened, dissolved, or worn away and relocated by natural processes (e.g. rainfall, flowing water, wind, ice, temperature change, gravity) or by human-driven activities (e.g. agriculture, construction). Topsoil is an important soil layer containing organic matter, plant nutrients, and biological activity. The loss of topsoil is the most significant on-site consequence of erosion. Related to erosion, sedimentation occurs when soils are deposited into water, potentially decreasing the water quality and accelerating the aging process of the water body. When the natural rate of erosion has been significantly increased due to human activities or changes in climatic conditions, erosion and sedimentation can lead to increased rates of surface runoff, decreased water quality, and related environmental damage.

Within Carlsbad, erosion from water, wind, and agricultural/development tillage, as well as coastal erosion from storms and rising sea-levels have the potential to threaten the city's water quality, economic viability, and supply of natural resources. In terms of coastal erosion, beaches are the first line of defense against ocean waves, providing a buffer between the waves and coastal properties. When beaches are cut back during storms, they progressively lose their buffering ability, making further erosion more likely. The most direct approach to reduce or avoid coastal erosion is to limit the amount of development in the areas likely to be affected by coastal erosion. In addition, the city has identified specific areas where additional protection efforts are necessary, including drainage/erosion, slope stability, and seismic hazards; within the Coastal Zone, the city has designated these areas as part of the Coastal Resource Protection Overlay Zone.

### **Expansive Soils**

Certain types of soil are inherently expansive, meaning they can expand and contract as the water content fluctuates within the soil. This expansion and contraction, also called "shrink-swell," can damage structures that are not appropriately engineered for this activity. The U.S. Department of Agriculture (USDA) analyzes the shrink-swell potential of each soil type, and categorizes it as "low," "moderate," "high," or "very high." Where the shrink-swell classification is moderate to very high, shrinking and swelling can damage buildings, roads and other structures.<sup>5</sup> Most of the soils in Carlsbad have low shrink-swell potential.

### **Land Subsidence**

Land subsidence is the sinking of a large area of ground surface with little or no horizontal movement. Subsidence areas typically occur where groundwater or natural gas is extracted. Soils in San Diego County are generally granitic and there have been no documented incidents of subsidence in the county or the city.

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<sup>5</sup> USDA (U.S. Department of Agriculture). 2012. *National Soil Survey Handbook*. Part 618, Soil Properties and Qualities, Definition and Purpose (618.00). Accessed September 25, 2012.  
<http://soils.usda.gov/technical/handbook/contents/part618.html#38>.



## **REGULATORY SETTING**

This section summarizes key federal, state, regional, and city regulations, plans, and programs related to geology, soils, and seismicity in Carlsbad.

### **Federal**

#### ***U.S. Geological Survey Landslide Hazard Program***

The USGS created the Landslide Hazard Program in the mid-1970s; the primary objective of the program is to reduce long-term losses from landslide hazards by improving our understanding of the causes of ground failure and suggesting mitigation strategies. The federal government takes the lead role in funding and conducting this research, whereas the reduction of losses due to geologic hazards is primarily a state and local responsibility. In San Diego County, plans and programs designed for the protection of life and property are coordinated by the Unified San Diego County Emergency Services Organization.

### **State Regulations**

#### ***California Building Code***

The California Building Code (CBC), known as the California Building Standards Code, is included in Title 24 of the California Code of Regulations. The CBC incorporates the International Building Code (IBC), a model building code adopted across the United States. Through the CBC, the State provides a minimum standard for building design and construction. The CBC contains specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. It also regulates grading activities, including drainage and erosion control.

The CBC has been amended and adopted as Title 18 of the Carlsbad Municipal Code, which regulates all building and construction projects within the city.

#### ***California Alquist–Priolo Earthquake Fault Zoning Act***

The Alquist–Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures used for human occupancy. The main purpose of the law is to prevent the construction of buildings used for human occupancy on top of active faults. The law only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards, such as ground shaking or landslides.

The law requires the State Geologist to establish regulatory zones (known as Earthquake Fault Zones or Alquist–Priolo Zones) around the surface traces of active faults, and to issue appropriate maps. The maps are then distributed to all affected cities, counties and state agencies for their use in planning and controlling new or renewed construction. Generally, construction within 50 feet of an active fault zone is prohibited. The California Geological Survey does not identify Carlsbad on its list of cities affected by Alquist–Priolo Earthquake Fault Zones.

### **California Seismic Hazards Mapping Act**

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides. Under this law, seismic hazard zones are to be mapped by the State Geologist to assist local governments in land use planning. The law states that it is a necessity to identify and map seismic hazards so that cities and counties can adequately prepare the safety element of their general plan as well as encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety. According to California Seismic Hazards Mapping Act Section 2697(a), cities and counties shall require a geotechnical report defining and delineating any seismic hazard related to a project, prior to the approval of any project located in a seismic hazard zone. The State Geologist has mapped part of the northwestern San Diego County, but the map does not include Carlsbad as it is not affected by Seismic Hazards Zonation Program Zones.

### **National Pollution Discharge Elimination System Permits**

In California, the State Water Resources Control Board (SWRCB) and its Regional Water Quality Control Board (RWQCB) administer the National Pollution Discharge Elimination System (NPDES) program. The NPDES permit system was established as part of the Federal Clean Water Act to regulate both point source discharges and non-point source discharges to surface water of the United States, including the discharge of soils eroded from construction sites.

The NPDES program consists of characterizing receiving water quality, identifying harmful constituents (including siltation), targeting potential sources of pollutants (including excavation and grading operations), and implementing a comprehensive stormwater management program. Construction and industrial activities typically are regulated under statewide general permits that are issued by the SWRCB. Additionally, the SWRCB issues Water Discharge Requirements that also serve as NPDES permits under the authority delegated to the RWQCBs, under the Clean Water Act.

### **Local Regulations**

#### **San Diego County Multi-Jurisdictional Hazard Mitigation Plan**

The 2010 San Diego County Multi-Jurisdictional Hazard Mitigation Plan (HAZMIT) was prepared to comply with the Disaster Mitigation Act of 2000 to increase disaster planning funding. It is intended to educate the public, help serve as a decision-making tool, supplement and enhance local policies regarding disaster planning, and improve multi-jurisdiction coordination. The following topics related to geology, soils, and seismicity are addressed in the HAZMIT:

- Earthquake
- Liquefaction
- Rain-Induced Landslide

The HAZMIT identifies earthquake as one of the top five hazards in Carlsbad due to the potential loss of life, injuries, and damage to property, as well as the significance in the disruption of services. The HAZMIT identifies goals for hazard mitigation in Carlsbad, including “reducing the possibility of damage and losses to existing assets, including people, critical facilities/infrastructure, and public facilities due to earthquakes.” Various actions are outlined in the HAZMIT to assist the city in reaching this goal.<sup>6</sup>

### **Resource Conservation District of Greater San Diego County**

The Resource Conservation District (RCD) of Greater San Diego County was formed in 1941 and encompasses a service area of approximately 2,886 square miles. The RCD is responsible for locally securing the adoption of conservation practices for resources including but not limited to, farm, range, open space, urban development, wildlife, recreation, watershed, water quality, and woodland. Their practices are best adapted to save the basic resources of the state from unreasonable and preventable waste and destruction.

In partnership with the USDA’s Natural Resource Conservation Service, the RCD of Greater San Diego County provides technical assistance for conservation practices, including irrigation and water management, erosion and flood control, waste management, and habitat restoration.

### **City of Carlsbad Grading Ordinance**

The city’s Grading Ordinance (Municipal Code Chapter 15.16), establishes minimum requirements for grading associated with development. The Grading Ordinance is intended to facilitate appropriate planning, design, and construction of development within the city, while ensuring compatibility with associated physical conditions, environmental resources and legal/regulatory requirements. The Grading Ordinance requires that a grading permit be obtained prior to grading, including the clearing and grubbing of vegetation. The grading permit requires a stormwater maintenance program, construction stormwater pollution prevention plan, and other such documentation and information as may be necessary to demonstrate that the grading work will be carried out in substantial compliance with all city codes and standards, and the requirements of the city’s Landscape Manual.

### **City of Carlsbad Building Code**

The city Building Code (Municipal Code Title 18) is intended to regulate the construction of applicable facilities, and encompasses (and formally adopts) associated elements of the IBC/CBC. Specifically, this includes guidelines related to “regulating the erection, construction, enlargement, alteration, repair, moving, removal, demolition, conversion, occupancy, equipment, use, height, area, and maintenance of all buildings or structures in the city of Carlsbad...”

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<sup>6</sup> County of San Diego. 2010. *Multi-jurisdiction Hazard Mitigation Plan San Diego County, California*. July 2010. Accessed September 24, 2012. [http://www.co.san-diego.ca.us/oes/docs/2010\\_HazMit\\_Plan.pdf](http://www.co.san-diego.ca.us/oes/docs/2010_HazMit_Plan.pdf).

### **City of Carlsbad Municipal Code Chapter 13.20 – Septic Tank Systems**

Chapter 13.20 of the city's Municipal Code governs the installation and construction of septic tank systems within the city. Septic tank systems are not permitted unless the public sewer system is not adjacent to the proposed development or the utilities director determines that extension of the public sewer system is not feasible; or the sewer moratorium pursuant to Section 18.05.020 of this code is in effect and none of the exceptions of that section are applicable. All septic tank systems that are permitted are required to meet all requirements of the city's Municipal Code as well as Chapter 3 of Division 8 of Title 6 of San Diego County Code of Regulatory Ordinances.

### **Technical Guidelines for Geotechnical Reports**

The city's Geotechnical Report Guidelines identify specific requirements for various levels of geotechnical evaluation, including reconnaissance studies, preliminary geotechnical investigation reports, and as-graded geotechnical reports. Guidelines for all of the noted reports include requirements such as literature review; field investigation/mapping; descriptions of geologic, seismic, and engineering conditions; and conclusions/recommendations to identify potential issues and related mitigation requirements, and to ensure conformance with applicable regulations and standards.

## **Impact Analysis**

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### **SIGNIFICANCE CRITERIA**

For the purposes of this Program EIR, a significant impact would occur if the proposed General Plan would:

- Expose people or structures to potentially substantial adverse effects, including the risk of loss, injury or death involving: (1) rupture of a known earthquake fault as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map; (2) strong seismic ground shaking; (3) seismic-related ground failure, including liquefaction; or (4) landslides;
- Result in substantial soil erosion or the loss of topsoil;
- Be located on a geologic unit or soil that is unstable, or that may become unstable as a result of the project, and potentially result in on-site or off-site landslides, lateral spreading, subsidence, liquefaction or collapse;
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property; or
- Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

### **METHODOLOGY AND ASSUMPTIONS**

Potential impacts resulting from implementation of the proposed General Plan were evaluated based on relevant information from the California Department of Conservation and California

Geological Survey. Based on a review of relevant maps and geologic documentation, this Program EIR presents the potential for geological impacts to occur within Carlsbad. Programmatic impacts are discussed in broad, qualitative terms. This assessment does not satisfy the need for project-level California Environmental Quality Act analysis for individual projects. Individual projects under the proposed General Plan will require a project-level analysis at the time they are proposed based on the details of these projects and the existing conditions at the time such projects are pursued.

## SUMMARY OF IMPACTS

Future development under the proposed General Plan could result in substantial adverse effects from seismic ground shaking, or seismic-related ground failure. However, as described below, the proposed General Plan includes goals and policies that focus on geology, soil, and seismic safety. Implementation of these goals and policies would ensure potential impacts would remain below a level of significance.

## IMPACTS

**Impact 3.5-1 The proposed General Plan would not expose people or structures to potentially substantial adverse effects, including the risk of loss, injury or death involving: (1) rupture of a known earthquake fault as delineated on the most recent Alquist–Priolo Earthquake Fault Zoning Map; (2) strong seismic ground shaking; (3) seismic-related ground failure, including liquefaction; or (4) landslides. (Less than Significant)**

### 1. Alquist–Priolo Fault Rupture Zone

Carlsbad is located within seismically active Southern California, an area where several faults and fault zones are considered active by the California Department of Conservation, Division of Mines and Geology. Alquist–Priolo Earthquake Fault Zones have been established for the majority of these faults and fault zones. The purpose of the Alquist–Priolo Earthquake Fault Zones is to prohibit the location of structures on the traces of active faults, thereby mitigating potential damage due to fault surface rupture. According to the California Geological Survey, Carlsbad is not listed as being affected by an Alquist–Priolo Earthquake Fault Zone.<sup>7</sup> Therefore, potential adverse effects to people or structures from the rupture of a known earthquake fault would be less than significant.

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<sup>7</sup> California Geological Survey. 2007. "Fault-Rupture Hazard Zones in California: Alquist-Priolo Earthquake Fault Zones, Cities and Counties Affected by Alquist-Priolo Earthquake Fault Zones as of January 2010." Sacramento, California: California Department of Conservation, California Geological Survey. Accessed July 29, 2013. <http://www.conservation.ca.gov/cgs/rghm/ap/Pages/affected.aspx>.

## 2. Strong Seismic Ground Shaking

Carlsbad is located within a seismically active region, and earthquakes have the potential to cause ground shaking of significant magnitude. Figure 3.5-2 displays the location and extent of the profiled earthquake faults within San Diego County based on USGS earthquake model that shows probabilistic peak ground acceleration. The nearest known faults are the Rose Canyon and Newport–Inglewood faults, located approximately 3.8 miles west and approximately 4 miles northwest of the city’s western boundary, respectively.<sup>8</sup> Although located near fault lines, Carlsbad lies within a medium-low probabilistic peak ground acceleration zone. The proposed General Plan would allow for additional development within the city, which could expose people and property to strong seismic ground shaking. However, new buildings would be constructed in compliance with the city’s Building Codes and Regulations (Municipal Code Title 18), which adopts the 2013 Edition of the CBC, Volumes 1 and 2. Section 1613 of the CBC requires all structures be designed and constructed to resist the effects of earthquake motions in accordance with the *Minimum Design Loads for Buildings and Other Structures* established by the American Society of Civil Engineers. Additionally, the proposed General Plan policies listed below (6-G.1, 6-P.9, 6-P.10, 6-P.11, 6-P.12, 6-P.13, 6-P.14, 6-P.15, 6-P.16, and 6-P.17) would further reduce any potential impacts associated with strong seismic ground shaking. Therefore, compliance with the CBC and implementation of the proposed General Plan would result in less-than-significant impacts to people and structures from strong seismic ground shaking.

## 3. Seismic-Related Ground Failure, Including Liquefaction

The city has a low liquefaction risk; however, there are areas of the city that have a higher risk of liquefaction due to the presence of hydric soils or soils that are often saturated or characteristic of wetlands.<sup>9</sup> These areas are limited to the immediate vicinity of the Buena Vista, Agua Hedionda, and Batiquitos lagoons, as shown in Figure 3.5-3. The proposed General Plan would allow for additional development in areas that may be at risk for liquefaction; however, new buildings would be constructed in compliance with the city’s Building Codes and Regulations (Municipal Code Title 18), which adopts the 2013 Edition of the CBC, Volumes 1 and 2. Risks from liquefaction would be analyzed as part of the development review process and potential dangers from liquefaction would be addressed as required by the CBC, including Section 1610, Soil Lateral Loads, which requires design that resists lateral soil loads. Potential design considerations could include removal or re-compaction of liquefiable soils, in site ground densification, ground modification and improvement, deep foundations, reinforced shallow foundations, and reinforced structures to resist deformation during liquefaction. In addition, the proposed General Plan policies listed below (6-G.1, 6-P.10, 6-P.11, 6-P.12, 6-P.13, 6-P.14, 6-P.15, 6-

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<sup>8</sup> County of San Diego. 2009. “Draft-Earthquake County of San Diego Hazard Mitigation Planning” [map]. County of San Diego, Department of Planning and Land Use and Office of Emergency Services.

<sup>9</sup> City of Carlsbad. 1994. *Final Master Environmental Impact Report for the City of Carlsbad General Plan Update*. City of Carlsbad, Planning Department. March 1994.

P.16, and 6-P.17) would further reduce potential seismic-related impacts. Therefore, compliance with the CBC and implementation of the proposed General Plan would result in a less-than-significant impacts to people and structures from seismic-related ground failure, including liquefaction.

#### 4. Landslides

Landslide risk is determined by steep slopes that have 25 percent or greater incline, soil series data, and soil-slip susceptibility. Carlsbad does not include any areas identified as being susceptible to landslides and the overall risk of landslides is low. In addition, the proposed General Plan policies listed below (6-G.1, 6-P.10, 6-P.11, 6-P.12, 6-P.13, 6-P.14, 6-P.15, 6-P.16, and 6-P.17) would ensure that impacts associated with landslides would remain below a level of significance.

### ***Proposed General Plan Policies that Reduce the Impact***

#### *Public Safety Element Goals*

- 6-G.1** Minimize injury, loss of life, and damage to property resulting from fire, flood, hazardous material release, or seismic disasters.

#### *Public Safety Element Policies*

- 6-P.9** Allow for consideration of seismic and geologic hazards at the earliest possible point in the development process, preferably before comprehensive engineering work has commenced.
- 6-P.10** Maintain geotechnical report guidelines identifying specific requirements for various levels of geotechnical evaluation, including reconnaissance studies, preliminary geotechnical investigation reports, and as-graded geotechnical reports.
- 6-P.11** Use information in Figure 6-4 in Chapter 6 of the General Plan as a generalized guideline for planning purposes and in determining the type and extent of geotechnical report to be required for a proposed development project. When a geotechnical report is required, require submission of the report and demonstration that a project conforms to all mitigation measures recommended in the report prior to city approval of the proposed development.
- 6-P.12** Require a geotechnical investigation and report of all sites proposed for development in areas where geologic conditions or soil types are susceptible to liquefaction. Also require demonstration that a project conforms to all mitigation measures recommended in the geotechnical report prior to city approval of the proposed development (as required by State law).
- 6-P.13** Prohibit location of critical structures directly across known earthquake faults unless a geotechnical and/or seismic investigation is performed to show that the earthquake fault is neither active nor potentially active.



- 6-P.14** Require applicants to conduct detailed geologic and seismic investigations at sites where the construction of critical structures (high-occupancy structures and those that must remain in operation during emergencies) and structures over four stories are under consideration.
- 6-P.15** In accordance with the California Subdivision Map Act, deny subdivision maps if a project site is not physically suitable for either the type or density of a proposed development because of geologic, seismic, or other hazards.
- 6-P.16** Require qualified geotechnical engineering professionals to review grading plans and inspect areas of excavation during and after grading, to evaluate slope stability and other geotechnical conditions that may affect site development and public safety. In areas of known or suspected landslides and/or adverse geologic conditions, the following determinations should be made: extent of landslide, depth-to-slide plane, soil types and strengths, presence of clay seams and ground water conditions.
- 6-P.17** Continue to regulate development, including remodeling or structural rehabilitation, to ensure adequate mitigation of safety hazards on sites having a history or threat of seismic dangers, erosion, subsidence, or flooding.

***Mitigation Measures***

None required.

**Impact 3.5-2 The proposed General Plan would not result in substantial soil erosion or the loss of topsoil. (Less than Significant)**

As described in the Environmental Setting section above, Carlsbad has the potential for erosion from water, wind, and agricultural/development tillage, as well as coastal erosion from storms and rising sea-levels. The proposed General Plan would allow for additional development within the city that may increase soil erosion or loss of topsoil. However, development under the proposed General Plan would be subject to local and state building codes and requirements for erosion control and grading. In addition, all new development and redevelopment projects would be required to comply with the city's Grading Ordinance (Municipal Code Chapter 15.16), which establishes minimum requirements for grading, including the requirement to obtain a grading permit prior to any grading activities. The grading permit requires a stormwater maintenance program, construction stormwater pollution prevention plan, and other such documentation and information as may be necessary to demonstrate that the grading work will be carried out in substantial compliance with all city codes and standards, and the requirements of the city's Landscape Manual. In addition, the city has identified specific areas where additional protection efforts are necessary, including steep slopes, drainage/erosion, slope stability, seismic hazards, and floodplains; within the Coastal Zone, these areas are designated as part of the Coastal Resource Protection Overlay Zone.

While all development has the potential to increase soil erosion from vegetation removal, grading, and development activities, no actions are proposed by the proposed General Plan that would increase these events of soil erosion. Compliance with the city's regulations, codes, and ordinances discussed above; proposed General Plan policies listed below; and federal, state, and local laws and regulations concerning building construction, would reduce program-level soil erosion impacts to less than significant.

### ***Proposed General Plan Policies that Reduce the Impact***

#### ***Public Safety Element Policies***

The following proposed General Plan goals and policies listed in Impact 3.5-1 above would also reduce potential erosion impacts to less than significant: 6-G.1, 6-P.9 through 6-P.11, and 6-P.15 through 6-P.17.

#### ***Land Use and Community Design Element Policies***

**2-P.43** Evaluate each discretionary application for development of property with regard to the following specific criteria [only relevant sub bullet included]:

- b. Site design and landscaping to provide buffers and screening where appropriate, conserve water, and reduce erosion and runoff.

### ***Mitigation Measures***

None required.

### **Impact 3.5-3 The proposed General Plan would not be located on a geologic unit or soil that is unstable, or that may become unstable as a result of the project, and potentially result in on-site or off-site landslides, lateral spreading, subsidence, liquefaction or collapse. (Less than Significant)**

As shown in Figure 3.5-3, Carlsbad does not include any areas identified as being susceptible to landslides, and the overall risk of landslides is low. Subsidence areas typically occur where groundwater or natural gas is extracted. Soils in San Diego County are generally granitic, and there have been no documented incidents of subsidence in the county or the city. Additionally, the city has a low liquefaction risk; however, there are areas of the city that have a higher risk of liquefaction due to the presence of hydric soils or soils that are often saturated or characteristic of wetlands. These areas are limited to the immediate vicinity of the Buena Vista, Agua Hedionda, and Batiquitos lagoons, as shown in Figure 3.5-4. Although implementation of the proposed General Plan could result in development on a geologic unit or soil that is unstable or may become unstable, future development would be required to comply with the city's Grading Ordinance (Municipal Code Chapter 15.16), which requires a geotechnical investigation as part of the grading permit application process that would identify potential hazards and provide recommendations consistent with city standards. In addition, the proposed General Plan includes the following goal and policies, as discussed above under Impact 3.5-1, that would further reduce impacts to a less than significant level.

**Proposed General Plan Policies that Reduce the Impact**

The proposed General Plan goal and policies: 6-G.1, 6-P.9 through 6-P.12, and 6-P.14 through 6-P.17, as discussed above under Impact 3.5-1, would reduce potential impacts associated with unstable soils.

**Mitigation Measures**

None required.

**Impact 3.5-4 Development under the proposed General Plan would not be located on expansive soil, as defined in Table 18-I-B of the Uniform Building Code (1994), creating substantial risks to life or property. (Less than Significant)**

Although most of the soils in Carlsbad have low shrink-swell potential, implementation of the proposed General Plan could result in development on expansive soil. However, future development would be required to comply with the city's Grading Ordinance (Municipal Code Chapter 15.16), which requires a geotechnical investigation as part of the grading permit application process that would identify potential hazards and provide recommendations consistent with city standards. In addition, the proposed General Plan includes the following goal and policies that would further reduce impacts to a less than significant level.

**Proposed General Plan Policies that Reduce the Impact**

The proposed General Plan goal and policies: 6-G.1, 6-P.9 through 6-P.12, and 6-P.14 through 6-P.17, as discussed above under Impact 3.5-1, would reduce potential impacts associated with expansive soils.

**Mitigation Measures**

None required.

**Impact 3.5-5 Development under the proposed General Plan would not be located on soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water, creating hazards. (Less than Significant)**

The City of Carlsbad Sewer Service Area includes the majority of the city, with the exception of the southeast corner of the city. Wastewater collection in the southeastern area, which includes the community of La Costa, is provided by Vallecitos Water District (VWD) and the Leucadia Wastewater District (LWWD). Carlsbad's Sewer Service Area extends from the Pacific Coast approximately 4 to 5 miles inland, providing wastewater collection, treatment, and disposal service to customers within its 30.5-square-mile service area. Sewer flows are conveyed in six interceptors to the Encina Water Pollution Control Facility (EWPCF), which is along the coast

and approximately centered north–south in the service area. Five lift stations are part of the interceptor system and 11 smaller lift stations are required in the collection system to convey wastewater flows to the EWPCF.

However, the implementation of the proposed General Plan would allow for additional development in areas that may require installation of septic tank systems. The installation of septic tank systems is governed by Chapter 13.20 of the city’s Municipal Code, which prohibits septic tank systems unless the public sewer system is not adjacent to the proposed development or the utilities director determines that extension of the public sewer system is not feasible; or the sewer moratorium pursuant to Section 18.05.020 of this code is in effect and none of the exceptions of that section are applicable. Additionally, all septic tank systems that are permitted are required to meet all requirements of the city’s Municipal Code as well as Chapter 3 of Division 8 of Title 6 of the San Diego County Code of Regulatory Ordinances. Through compliance with the city’s and the county’s septic tank requirements, the proposed General Plan would not result in the installation of septic tanks in soils incapable of adequately supporting the use of such systems. Therefore, impacts would be less than significant.

***Proposed General Plan Policies that Reduce the Impact***

No specific policies related to the capability of soils to support the use of septic tanks or alternative waste water disposal systems are provided in the proposed General Plan.

***Mitigation Measures***

None required.